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THE FORMER CRAWFORD STATION MANUFACTURED GAS PLANT
PROPERTY OF
CHICAGO, ILLINOIS

SITE INVESTIGATION REPORT

Prepared for
THE PEOPLES GAS
LIGHT and COKE COMPANY

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PROJECT NO. 25958

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EXECUTIVE SUMMARY

In conformance with the Illinois Environmental Protection Agency (Illinois EPA) Site Remediation Program (SRP), defined in Chapter 35 of the Illinois Administrative Code (IAC), Part 740, The Peoples Gas Light and Coke Company (Peoples Gas) engaged Burns & McDonnell to perform a site investigation (SI) on a portion of the former Crawford Station property in Chicago, Illinois. This report summarizes SI activities and presents SI findings.

The former Crawford Station encompassed 260-acres of land northwest of the intersection of Interstate 55 and Pulaski Avenue, and has subsequently been subdivided and sold to various parties. SI activities, presented herein, were conducted on a 35.5 acre portion of the former property, referred to as Property O (Site). Property O consists of 35.5-acres of land stretching across the southern section of the former Crawford Station property with a section running north along Pulaski Avenue to 35th Place and a section running north from the Peoples Gas building across both 36th Street and 35th Place and is the subject of the investigation described in this SI Report. This SI Report specifically excludes the other portions of the former Crawford Station property. Current structures on Property O include a large warehouse building and several regulating and metering structures, all located in the central area of the east-west portion of Property O.

In 1921, the Koppers Company of Pittsburgh and Peoples Gas entered into an agreement whereby Koppers built and financed the Crawford Station. Under the terms of the contract, the Chicago By-Product Coke Company was formed to own and operate the plant. Peoples Gas then bought the gas and coke manufactured at the plant for distribution to consumers. Peoples Gas acquired the Chicago By-Product Coke Company in 1938. The former Crawford Station produced coke oven, carbureted water and reformed natural gas. The gas manufacturing processes used resulted in the production of by-products, predominantly coal tars. Production was temporarily halted between 1958 and 1962 and permanently after 1963. Dismantling of the station began in 1956 starting with portions of the coke oven plant. The remainder of the station, including the two 10 million cubic foot gas holders, were dismantled and the plant was retired in 1965. Peoples Gas sold 146 of the original 260 acre site to First American Realty Company in 1966.

SI field activities were performed in accordance with an approved work plan. SI field activities were performed from May through July 2001. A total of 128 soil probes were advanced at various locations across the Site. Soil samples were collected from various depths within each soil probe and delivered to an analytical laboratory and analyzed for chemical and physical properties. Twenty-two soil probe locations were also converted to two-inch PVC monitoring wells, from which groundwater samples were collected and analyzed for constituents of concern.

The following stratigraphic units, listed in descending order, were identified at the Site: fill, brown/gray silty clay unit and gray silty clay unit. Fill materials consisted primarily of sand with smaller amounts of silt, clay, gravel, brick, cinders, and wood. Underlying the fill is up to 14 feet of native brown/gray silty

clay. The brown/gray unit ranges from silty clay with trace sand and gravel to a silty clay with some sand. The brown/gray unit also contains some small fractures. Underlying the brown/gray unit is a native, gray silty clay unit, presumably the Carmi Member of the Equality Formation. This unit ranges from a silty clay to clay with a trace of sand and fine gravel.

During SI field activities, odors, staining and various amounts of tar were observed in three areas of the Site. The first area is in the southwest section of the Site and is the largest. Tar saturated sand was observed beginning from 9 feet bgs to 10 feet bgs and was observed as tar in fractures, one to two feet below initial tar saturated sand in the brown/gray silty clay. The tar in fractures typically ends between 15 to 16 feet bgs. The second area is in a small strip of land north of 36th Street, located approximately 300 feet south of 35th Place. Subsurface soils at SP111 had a small amount of sheen on them at 14 feet bgs, with minor odors. The final area is in the eastern section of the property near Pulaski Avenue. The soils in this section only had odors; no tar was visually observed. Migration of constituents appears to be mainly through fractures in the brown/gray silty clay unit encountered at the Site.

Based on an Illinois EPA Tiered Approach to Corrective Action (TACO) Tier 1 evaluation for industrial/commercial properties, several constituents in soil samples exceeded Tier 1 levels for soil ingestion, soil inhalation and soil migration to class II groundwater, and constituents in groundwater samples exceeded Tier 1 levels for ingestion. In general, polynuclear aromatic hydrocarbons (PAHs) and arsenic were the only compounds that exceed the screening levels for the soil ingestion exposure route, and benzene and naphthalene were the only compounds that exceeded the soil inhalation exposure route. Benzene, toluene, ethylbenzene, and xylenes (BTEX), PAHs, nitrobenzene, n-nitrosodi-n-propylamine, and several metals exceed the soil migration to class II groundwater exposure route. Benzo(a)anthracene, naphthalene and lead were the only compounds exceeding the groundwater ingestion exposure route for Class II water.

Based on visual observations, only one area of source material was identified at the Site. This area is in the southwest section of the Site, just south of Properties A and B (Figure 7). Within this area of the Site, tar saturated soil exists from approximately 10 feet bgs to 13 feet bgs and tar in fractures exists from approximately 13 feet bgs to 15 feet bgs. The tar in fractures was typically observed in the brown/gray silty clay layer and ended before the gray silty clay layer. A small area of surface tar was observed near this area, which overlays the four high pressure gas lines onsite.

The overall objective of the SI was to determine the extent to which past activities and operations of the former Crawford Station and/or other onsite/offsite activities have impacted the soil and groundwater of the Site. The objectives of the SI were met and the nature and extent of impacted areas were defined. Remediation objectives will be established in the forthcoming Remediation Objectives Report (ROR). The ROR will present remediation objectives proposed to eliminate or prevent exposure to constituents of concern and tar found at the Site.

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1.0 SITE CHARACTERIZATION

In conformance with the Illinois Environmental Protection Agency (Illinois EPA) Site Remediation Program (SRP), defined in Chapter 35 of the Illinois Administrative Code (IAC), Part 740, The Peoples Gas Light and Coke Company (Peoples Gas) engaged Burns & McDonnell to perform a site investigation (SI) on a portion of the former Crawford Station property in Chicago, Illinois. This report summarizes SI activities and presents SI findings.

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1.1 SITE DESCRIPTION

Property O is located in the West Township of the City of Chicago, Illinois in the County of Cook and is approximately thirty-five and a half (35.5) acres in size. Figure 1 presents the site location map. The Site is contained completely within the former Crawford Station property, and primarily makes up a narrow strip east to west across the southern end of the former Crawford Station property. The Site's legal description is as follows:

Legal Description Pending. To be included in final report.

1.2 SITE HISTORY

In 1921, the Koppers Company of Pittsburgh and Peoples Gas entered into an agreement whereby Koppers built and financed the Crawford Station property. Under the terms of the contract, the Chicago By-Product Coke Company was formed to own and operate the plant. Peoples Gas then bought the gas and coke manufactured at the plant for distribution to consumers. Peoples Gas acquired the Chicago By-Product Coke Company in 1938. Initial facilities at the Site included 105 coke ovens (increased to 151 coke ovens between 1948 and 1950), nine (9) water gas sets and two 10 million cubic foot water-seal gas holders. In the 1930's, a light oil refining plant and a liquefied petroleum gas peak shavings facility were added to the Crawford Station and five of the nine water gas sets were converted to produce reformed natural gas and later oil gas. Forty liquefied petroleum tanks were installed in 1957. The former Crawford Station produced coke oven, carbureted water and reformed natural gas. The gas manufacturing processes used at this Site resulted in the production of by-products, predominantly coal tars. These by-products were stored in tanks onsite and were frequently sold to other companies for direct use or for conversion into other products. By 1956, the Crawford Station was only used to supply gas and

coke when the demand was high. Production was temporarily halted between 1958 and 1962 and permanently after 1963. Dismantling of the station began in 1956 starting with portions of the coke oven plant. The remainder of the station, including the two 10 million cubic foot gas holders were dismantled and the plant was retired in 1965. Peoples Gas sold 146 of the original 260 acre site to First American Realty Company in 1966.

Based on historic site plans, notable historic features on the north central area of Property O included a blower house and the western ends of two purifiers. A former meter and pressure regulating building, a former gas meter house, electric switch house, and former odorant tank were located on the southeast area of Property O. Natural gas lines ran parallel inside the east-west section of Property O. The eastern end of a former compressor building was located on the northeast portion of Property O. Two former 10 million cubic foot gas holders were located adjacent to the west of Property O and former propane tanks were located adjacent to the south of Property O. The majority of the primary structures of the former Crawford Station were located north and west of Property O and were used as production and storage facilities for manufactured gas. The facility halted production in 1963. The dismantling of the structures related to the Crawford Station were completed in 1956. Figure 2 presents the historical layout of the Site. Appendix A contains the Sanborn Maps that show the entire former Crawford Station site for years 1936, 1951, 1975, 1987, 1989 and 1992.

Peoples Gas still owns Property O, which is approximately 35.5 acres of the original 260-acre facility, and is currently used as a city gate regulating and metering facility. Current structures on Property O include a large warehouse building and several regulating and metering structures, all located in the central area of the east-west portion of Property O.

1.3 PREVIOUS INVESTIGATIONS

Hanson Engineers, Inc. (Hanson) prepared a report entitled "Preliminary Site Investigation Crawford Station" in February 1992 for the entire 260-acre parcel (Hanson 1992). The objective of the Hanson investigation was to determine if there were potential impacts, assess the degree of potential impacts, and assess the impacts on human health and the environment. The investigation included a review of the environmental setting, historical documents, Sanborn maps, and a water well survey. No previous investigations focused solely on the 35.5-acre Peoples Gas portion (Property O).

1.4 SITE PHYSIOGRAPHY AND SITE TOPOGRAPHY

Property O creates a shape similar to the letter 'F' with the long-narrow strip running east-west along the south edge of the Site and the two shorter strips running north-south along the far-eastern and central portions of the Site (Figure 2). This longer back segment of the 'F' lies immediately north of the Metropolitan Water Reclamation District of Chicago property (Property S). At the eastern border of the former Crawford Station property, the top segment of the 'F' reaches to the north ending half way up this eastern edge. Property O also occupies a narrow section running north and south, the middle segment of the 'F,' located approximately 1,200 feet west of the eastern border of the Site. The American National Bank & Trust Co. property (Property P) divides the north-south portion of Property O. To the west of the

north-south portion of Property O is the UIR Campus and Tower L.L.C property (Property T), the former Transamerica Financial Services property recently purchased by the Peoples Gas Light and Coke Company (Property L), and the Wonderview Corp. property (Property K). To the east of the north-south portion of Property O is the Commonwealth Edison property (Property Q).

According to the United States Geological Survey 7.5-Minute Quadrangle, (1993) the Site is at an elevation of approximately 600 feet above mean sea level. The Site is mostly flat with a sharp depression along the northern edge of the long back segment of the 'F.' Regional surface water flow appears to be toward the south toward the Chicago Sanitary and Ship Canal, which is located approximately 600 feet south of the Site.

1.5 REGIONAL GEOLOGICAL INFORMATION

Burns & McDonnell reviewed several published documents in an effort to understand the regional geological setting in the area of the Site. The Geologic Map of Illinois (Willman 1967) indicates that bedrock beneath the Site is Silurian Dolomite. Based on this map, the approximate depth below ground surface (bgs) to the bedrock surface is generally greater than 50 feet and bedrock is overlain by glacial deposits. The *Quaternary Deposits of Illinois* (Lineback 1979) map indicates that the surface soil at the Site is the Carmi Member of the Equality Formation, which is described as largely quiet water sediments deposited in ancient Lake Chicago. The *Quaternary Deposits* map also indicated that the Mackinaw Member of the Henry Formation might also be on or near the Site. The Carmi Member is described as well bedded silt and some clay. The Mackinaw Member of the Henry Formation consists of sand, pebbly sand and gravel deposited as outwash valley trains leading outward from the Wisconsinan glacier fronts (Willman 1975).

The publication entitled, *Stack Unit Mapping of Geologic Materials in Illinois to a Depth of 15 Meters*, (Berg and Kempton 1988) indicates that site soils consist of deposits less than 20 feet thick of the silty Carmi member of the Equality Formation overlying more than 20 feet of clay deposits of the Wedron Formation. *Plate 1: Land Burial of Municipal Wastes* and *Plate 2: Surface and Near-Surface Waste Disposal* contained in the publication entitled, *Potential for Contamination of Shallow Aquifers in Illinois*, (Berg and Kempton 1984) rate the aquifer susceptibility for the Site as C1 and D2, respectively. For land burial of municipal wastes, a rating of C1 indicates permeable bedrock within 20 to 50 feet of surface, overlain by till or other fine-grained material. For surface and near-surface waste disposal, a rating of D2 suggests uniform, relatively impermeable silty or clayey till at least 20 feet thick and no evidence of interbedded sand and gravel. These aquifer ratings suggest that near surface waste disposal exhibits a low likelihood of impacting shallow groundwater aquifers beneath the Site, but that land burial of municipal waste exhibits an intermediate likelihood of impacting groundwater.

1.6 HYDROGEOLOGY

The *Summary of the Geology of the Chicago Area* (Willman 1971) describes shallow groundwater in the Chicago area as being limited to sand and gravel horizons in unconsolidated soil and fractured bedrock aquifers. The unconsolidated materials in this area consist primarily of clay with isolated lenses of sand

material and are not considered aquifers. In the Chicago area, bedrock aquifers are found within Silurian, Ordovician and Cambrian formations, which are greater than 50 feet bgs.

Precipitation and surface seepage recharge shallow groundwater aquifers in the Chicago land area. The publication entitled, *Potential for Contamination of Shallow Aquifers in Illinois*, provides estimated hydraulic conductivities of typical geological materials in Illinois. Geological materials encountered at the Site include sand and gravel, silty sand, silt, and clay. Estimated hydraulic conductivities for these soil types are as follows:

- Clean sand and gravel 1×10^{-3} cm/sec
- Silty sand 1×10^{-5} to 1×10^{-3} cm/sec
- Silt 1×10^{-6} to 1×10^{-4} cm/sec
- Clay till 1×10^{-9} to 1×10^{-7} cm/sec

The Chicago Ship and Sanitary Canal (Canal) is the closest surface water body located adjacent to the southern boundary of the Site. According to the Illinois EPA, water quality within the Canal is generally poor (Hanson 1992). Survey stations upstream and downstream of the Site indicate that the greatest impact to water quality is from fecal coliform concentrations, due primarily to waste water treatment discharges (Hanson 1992). Natural surface water runoff flows in multiple directions. However, surface water is primarily directed toward the canal. Multiple storm sewer inlets are located around the Site, which direct most of the surface water into the City of Chicago's combined sewer system.

According to the Federal Emergency Management Agency (FEMA), the Site is not within the limits of the 100-year floodplain. A floodplain exists approximately 30 feet north of the Canal. No wetland areas are shown within the boundaries of the Site on the National Wetland Inventory maps developed by the U.S. Fish and Wildlife Service (internet map). However, Hanson sited two possible wetland areas, located along the western and southern site boundaries, that appear to be drainage ditches. The Illinois Department of Conservation's Natural Heritage Database lists no federal or state threatened and endangered species or pristine natural areas occurring in the vicinity of the Site.

1.7 METEOROLOGY

Weather in the area of the Site is continental in nature with cold dry winters and warm humid summers. Short duration, relatively large magnitude changes in temperature, humidity, precipitation, and wind direction are common. Annual mean weather conditions are as follows:

Precipitation	37.2 Inches
Temperature	51.8 Degrees Fahrenheit
Last Spring Freeze	April 9
First Fall Freeze	Oct. 28

Average temperatures are warmest during the month of July at 75.4 degrees Fahrenheit and coolest during the month of January at 24.7 degrees Fahrenheit. Precipitation varies from a low of 1.5 inches in

February to a high of 4.1 inches in June. Snowfall occurs mostly between late October and early April. Highest snowfall accumulation occurs in February, which has an average total monthly snowfall of 10 inches.

Wind direction is usually from the south, southwest or west. Wind in the area of the Site is from the south, southwest or west direction approximately 47.1 percent of the time. The most common wind direction is south, which occurs 11.9 percent of the time. Mean wind speed in the prominent wind direction (south) is 10.6 miles per hour.

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2.0 SITE SPECIFIC SAMPLING PLAN

SI field activities were performed in accordance with the *Work Plan for Former Crawford Station Site (Property O)* Chicago, Illinois (BMcD 2000). In general, field activities were completed as outlined in the work plan, except where field conditions warranted changes (i.e. boring/sample location(s) added, boring/sample location(s) moved due to field constraints, etc.). SI field activities were performed between May 8 to May 17, 2001 and between June 18 to July 5, 2001.

2.1 SOIL PROBE SAMPLING PROCEDURES

A total of 128 soil probes were advanced at various locations at the Site. Figure 3 shows the soil probe locations. Surface and subsurface soil samples were collected from probe locations using direct push sampling equipment. Probe locations were continuously sampled using 4-foot long 1.5-inch diameter stainless steel sample tubes lined with acetate liners. Each sample interval was field screened for volatile organic compounds (VOCs) using a photo-ionization detector (PID). Soil cuttings generated during sampling activities were collected in 55-gallon drums.

A stainless steel knife was used to facilitate sample collection from each acetate liner. Surface vegetation and/or carryover material from previous sampling intervals were removed before sampling. Soil samples were picked up at the Site by an analytical laboratory and analyzed for chemical and physical properties. Soil samples to be analyzed for VOCs were collected immediately after sample retrieval as possible in accordance with SW-846 Method 5035 using the following Powerstop Handle™ sampling procedures:

- An EasyDraw Syringe™ was inserted into the Powerstop Handle™.
- The EasyDraw Syringe™ was then pushed into a freshly exposed surface of soil until the syringe was full.
- The syringe was then removed from the handle and its contents inserted into pre-preserved 40-ml vial(s).

Soil samples to be analyzed for semivolatile organic compounds (SVOCs), priority pollutant metals and total cyanide were collected after collecting VOC samples. Soil was taken directly from the acetate liner, placed in clean sampling jars and the jar lids were secured. All soil samples were labeled and designated with a unique identifier, placed in a cooler packed with ice, and received by the subcontracted laboratory under proper chain-of-custody procedures.

Visual observations of soil type and condition were recorded on boring log forms. Field classification included principal and minor constituents, observed moisture (if any), soil color, soil texture, PID readings and impacts to the soil, if observed.

After completion of soil probing activities, probe locations were measured out to permanent site features. Soil probe holes were backfilled to 6 inches below ground surface (bgs) with bentonite chips. The remaining 6 inches were filled with gravel or patched with asphalt.

2.2 SURFACE SOIL INVESTIGATION

One hundred twenty seven (127) surface soil samples from soil probes SP001 through SP128, except SP088, were collected to evaluate surface soil quality at the Site. Samples were obtained from within the upper three (3) feet of the soil horizon. Figure 3 presents soil probe locations. Table 1 presents the surface soil sample depths and associated chemical analyses. The following subsections describe sampling locations, depths and chemical analyses performed on surface soil samples.

2.2.1 Surface Soil Sample Location and Depth

Surface soil samples were collected within the upper 3 feet of the Site's soil horizon at varying depths. Samples were collected from the following intervals: 0 to 3 inches, 0 to 1 foot, 1 foot to 2 feet, or 2 feet to 3 feet bgs. Surface soil samples were collected from probes SP001 through SP128, except SP088.

2.2.2 Chemical Analyses

Table 1 presents the analyses performed on each surface soil sample. In general, surface soil samples were analyzed for the following parameters:

- Target Compound List (TCL) VOCs
- TCL SVOCs
- Priority Pollutant Metals: antimony, arsenic, beryllium, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, thallium, and zinc.
- Total Cyanide

2.2.3 Physical Testing

Physical laboratory tests were performed on soil samples collected from SP078-001, SP083-001, SP115-001, and SP126-001. In general, soil samples were tested for the following physical parameters:

- soil pH
- moisture content
- percent organic carbon

2.3 SUBSURFACE SOIL INVESTIGATION

A total of 124 subsurface soil samples were collected from the 128 soil probes. Subsurface soils was visually characterized and scanned for constituents of concern using field instruments and field personnel's olfactory senses. Appendix B presents soil probe log forms, which summarize these observations. Subsurface soil samples were analyzed for chemical and physical properties. The following subsections describe sampling locations, depths and chemical and physical analyses performed on subsurface soil samples.

2.3.1 Subsurface Soil Sample Locations and Depths

Subsurface soil samples were collected from all soil probes except SP003, SP062, SP088, SP089, SP103, SP104, and SP107. Samples were not collected at these probe locations due to poor recovery or refusal.

Also, two subsurface samples were collected at SP002, SP012 and SP125. SP002-003 was collected to establish vertical extent of coal tar impact, and SP012-003 and SP125-03 were only collected for physical characteristic analysis. Subsurface soil samples were collected at soil probe locations at varying depths from 3 feet bgs to above the water table or where impacted conditions were observed below the water table, based on field personnel judgement. Subsurface soil samples were collected at each probe location, except the ones listed above. Figure 3 presents the soil probe locations.

2.3.2 Chemical Analyses

Table 2 presents the analysis performed on each subsurface soil sample. In general, subsurface soil samples were analyzed for TCL VOCs, TCL SVOCs, Priority Pollutant Metals, total cyanide, and, in select samples, the following additional parameters were analyzed for:

- Toxicity characteristic leaching procedure (TCLP) VOCs
- TCLP metals
- Tentatively Identified Compounds (TICs)
- Flashpoint
- British Thermal Units (BTU)
- Cyanide (reactive)
- Sulfide (reactive)
- Percent Ash
- Percent Solids
- pH

2.3.3 Physical Testing

Physical laboratory tests were performed on soil samples collected from SP012-003, SP022-002, SP119-002, and SP125-003. These soil samples were tested for the following physical parameters:

- soil pH
- moisture content
- percent organic carbon
- grain-size distribution

2.4 GROUNDWATER INVESTIGATION

Twenty-two soil probe locations were converted to 2-inch monitoring wells. Figure 3 depicts the monitoring well locations. Appendix C presents the well construction diagrams. Monitoring wells were installed with a truck mounted hollow-stem auger rig with 4 1/4" augers and were constructed of 2-inch diameter polyvinyl chloride (PVC) screen and casing materials. The annulus around each screen was backfilled with sand filter pack to 2 feet above the top of the screened interval and sealed with bentonite to within three feet bgs. A small amount of sand (approximately 3 inches) was added above the bentonite seal before the concrete pad and flush mounted well box were added to finish each monitoring well. Each location was developed using a 12-volt pump and sampled using a peristaltic pump. The following subsections describe sampling procedures and chemical analysis performed on groundwater samples.

2.4.1 Field Measurements

Static water level in each monitoring well was measured using a hand held electric water level indicator marked in increments of 0.01 foot. All water levels were collected from an established survey point marked on each monitoring well casing. Table 3 presents static water level measurement data.

2.4.2 Groundwater Sampling Procedures

A peristaltic pump with polyethylene tubing was used to purge standing water from the monitoring wells prior to sample collection. Between one to three well volumes were removed. Groundwater was withdrawn from the top of the standing water column to ensure that representative formation water was drawn into the casing and to prevent disturbance of sediment that may be present at the bottom of the casing.

After purging, groundwater samples were collected once a sufficient volume for sampling was available. A peristaltic pump with polyethylene tubing was used to collect groundwater samples from each well. The tubing was slowly lowered into the monitoring well, the pump was turned on, and groundwater was transferred directly into sample containers. New tubing was used in each monitoring well.

All groundwater samples were designated with a unique identifier and were placed in a cooler, packed with ice, and picked up at the Site or the Burns & McDonnell office in Oak Brook, Illinois by a subcontracted laboratory under proper chain-of-custody procedures.

2.4.3 Chemical Analyses

One groundwater sample was collected from eighteen (18) of the twenty-two (22) wells and analyzed for TCL VOCs, TCL SVOCs, amenable and total cyanide, and priority pollutant metals, as presented in Table 4. Groundwater samples were not collected from four (4) wells due to extremely low water levels or lack of water. A MS/MSD sample was collected at MW014.

3.0 FIELD OBSERVATIONS

This section presents field observations made during SI activities including surface and subsurface soil sampling, installation of groundwater monitoring wells, and groundwater sampling activities.

3.1 SITE GEOLOGY

During the SI, 128 soil probes ranging from 3 to 24 feet bgs were advanced at the former Crawford Site. Site geology was characterized during advancement of these soil probes and recorded on soil probe log forms. Appendix B presents the soil probe logs. The following stratigraphic units, listed in descending order, were identified at the Site: fill, brown/gray silty clay and gray silty clay. Asphalt and a gravel/sand subbase are at the surface in a few locations, and a sand layer is located above the brown/gray silty clay layer along the western edge of the property.

Seven geologic cross-sections showing subsurface soils encountered at the Site were prepared. Three cross-sections were prepared to show soils encountered across the whole of the former Crawford Station properties B-B' (running west to east), F-F' (running north to south) in the middle of the properties, and G-G' (running north to south) along Pulaski Avenue. The other four cross-sections were prepared to help define the impact area in the southwest portion of the property (Figure 4).

The following subsections describe each stratigraphic unit.

3.1.1 Fill Unit

The Site contains 0 to 13 feet of fill material. Fill thickness averages 11 feet in the southwest portion of the Site, in the area just south of Properties A and B, along the former railroad tracks. Further south in this section of the Site, fill thickness averages 6 feet around the high pressure gas lines. In the two sections of the property running north to south, no fill is present except where a probe was drilled in a roadway or parking area. Around the Peoples Gas office/repair shop building onsite, fill is about 4 feet thick. The fill consisted primarily of gravel and sand with smaller amounts of silt, clay, bricks, cinders, glass, and wood. Asphalt, where present, was 6 inches thick with up to 2 feet of gravel/sand subbase.

3.1.2 Brown/Gray Silty Clay Unit

Underlying the fill is a native layer of brown to brown/gray silty clay, up to 10 feet thick. The unit is a silty clay with a trace to some sand and gravel and often has orange mottling. The brown/gray silty clay layer was seen in all deep soil probe locations across the Site.

3.1.3 Gray Silty Clay Unit

Underlying the brown/gray silty clay layer is a native gray silty clay unit, presumably the Carmi Member of the Equality Formation. The top of the gray silty clay unit was encountered from 7 to 16 feet bgs; averaging approximately 10 feet bgs. The silty clay unit is consistently made of equal parts silt and clay

with traces of sand and gravel. The gray silty clay unit was encountered in all soil probes across the Site, with the exception of the shallow probe locations where probe refusal was encountered.

3.2 SITE HYDROGEOLOGY

During SI field activities, water was encountered in each probe location. The fill material acts as the main waterbearing unit for the Site with small sand lenses in the silty clay also contributing water. Twenty-two (22) soil probes had monitoring wells installed adjacent to them. Table 3 contains the water level measurement data for each well, and Appendix C contains monitoring well construction diagrams. Based on the water level measurements, the groundwater flow direction is east/northeast. Figure 5 presents the groundwater contours and the groundwater flow direction for the Site.

Recharge of the fill and silty clay units is expected to be local and most likely depends on precipitation. Depths to the tops of these units average 0 to 2 feet for the fill and 1 to 13 feet for the brown/gray silty clay. The soil classification results of 8 to 17% sand and gravel and 83 to 92% fines (silt and clay) does not meet the definition of a Class I aquifer, as defined in 35 IAC, Subtitle F, Chapter I, Part 620 – Groundwater Quality, Section 210. Additionally, the hydraulic conductivity for the Site was measured as 3.9×10^{-7} cm/s from a shelly tube sample taken at PCO-MW021 (Table 8). Therefore, the groundwater at the Site was evaluated based on Class II groundwater standards.

3.3 AREAS OF IMPACT

During SI field activities, three areas of impact were identified based on visual observations at the Site. Odors and/or staining were observed in two areas, and large to small amounts of tars were observed in the third area. The largest area is located along the southwestern property boundary with Properties A and B where tar saturated soil exists from approximately 10 feet bgs to 13 feet bgs and tar in fractures exists from approximately 13 feet bgs to 15 feet bgs. The tar in fractures was typically observed in the brown/gray silty clay layer and ended before the gray silty clay layer. All soil intervals were screened with a PID as described in section 2.1. PID readings were higher in the silty clay layer than near the surface and ranged from 0 to 134 ppm, with most readings under 40 ppm. A small area of surface tar was observed near this area, which overlays the four high pressure gas lines onsite.

The second area containing odors and a sheen is located in the north central portion of the Site at SP111. A PID reading of over 100 ppm was recorded at 14 feet bgs and a slight sheen was observed on the silty clay at that depth. The probe terminated at 14 feet due to refusal. Probes around SP111 show no such signs of impact.

The third and smallest area of impact is in the section of the Site that runs north along Pulaski Avenue. Probes SP067 and SP068 both had faint odors during sampling, but no visual impacts were observed. While installing MW017, faint petroleum odors were also noticed (Figure 3). PID readings of this zone ranged from 1.5 ppm to 357 ppm.

3.4 SOIL AND GROUNDWATER ANALYTICAL RESULTS

This section summarizes constituents encountered at Property O of the former Crawford Station. Information presented herein is based on field observations and chemical and physical analyses of soil and groundwater samples. Tables 5 through 10 present soil and groundwater analytical data results.

Test America Laboratories, Inc. of Bartlett, Illinois performed all sample analysis for both the soil and groundwater samples. The laboratories also reduced and validated analytical results in accordance with approved Illinois EPA Site Remediation Program analytical laboratory procedures. The report entitled, *Former Crawford Station Manufactured Gas Plant Property O (Peoples Gas Portion) Site Investigation Sampling Data*, (Burns & McDonnell 2001) contains a complete set of laboratory analytical result data sheets, data validation memoranda and summary tables of validated data.

Analytical results are presented in the following categories to aid in interpretation:

- Surface soil results.
- Subsurface soil results.
- Groundwater results.

3.4.1 Surface Soil Analytical Results

This section presents surface soil analytical results. All surface soil samples were collected between 0 and 3 feet bgs. Surface soil analytical results are presented in Tables 5 and 6. A statistical summary of all detected compounds/analytes is presented in Table 11.

3.4.1.1 Surface Soil TCL VOCs

TCL VOCs were detected in 17 of the 128 surface samples (Table 5). Acetone was detected in 2 of the 128 samples with concentrations ranging from 0.147 to 0.223 milligrams per kilogram (mg/kg). Additionally, chloroform, tetrachloroethene, 1,1,1-trichloroethane, trichloroethene were found in one surface sample with a concentration less than 0.2 mg/kg.

Benzene, ethylbenzene, toluene, and total xylenes, commonly referred to as BTEX, were also detected in several of the surface soil samples. The BTEX detected concentrations ranged from 0.0065 mg/kg (benzene at SP122) to 9.53 mg/kg (benzene at SP006). The highest concentrations of BTEX were detected along the border with Properties A and B in the southwest section of the Site.

3.4.1.2 Surface Soil TCL SVOCs

TCL SVOCs were detected in 82 of the 128 surface samples (Table 5). A total of 23 SVOCs were detected in the surface soil. Concentrations of detected compounds ranged from 0.12 mg/kg (benzo(a)pyrene at SP114) to 170 mg/kg (phenanthrene at SP082). The most frequently detected SVOCs were PAHs including acenaphthylene, anthracene, benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, chrysene, fluoranthene, naphthalene, phenanthrene, and pyrene.

Benzo(a)pyrene was detected in 66 of 128 samples ranging from 0.12 to 49.2 mg/kg. The highest concentrations of SVOCs were detected near the parking area by the Peoples Gas training station onsite.

3.4.1.3 Surface Soil Priority Pollutant Metals and Total Cyanide

At least four priority pollutant metals were detected in each of the 128 surface samples (Table 6). Antimony and thallium were non-detect in all surface soils. Arsenic, beryllium, chromium, copper, lead, nickel and zinc were detected in the vast majority of samples (Table 11). Detected arsenic concentrations ranged from 2.8 to 133 mg/kg; beryllium concentrations ranged from 0.29 to 1.8 mg/kg; chromium concentrations ranged from 4.1 to 180 mg/kg; copper concentrations ranged from 14 to 156 mg/kg; lead concentrations ranged from 6.6 to 234 mg/kg; nickel concentrations ranged from 6.6 to 54 mg/kg; and zinc concentrations ranged from 2.4 to 551 mg/kg. Metal concentrations were detected in the surface soil samples throughout the Site. The highest metals concentrations were encountered on the eastern portion of the property near the ComEd facility (Property Q).

Total cyanide was detected in 37 of the 128 surface soil samples and ranged in concentration from 0.31 to 15.1 mg/kg. The highest concentration of total cyanide was found at SP106 just north of a group of four former purifiers in the north-central extension of Property O.

3.4.1.4 Additional Parameters for Surface Soil

Based upon field observations/conditions, no surface soil samples were analyzed for additional parameters.

3.4.1.5 Surface Soil Physical Data Results

Four (4) surface soil samples were collected and tested for moisture content, pH and organic matter. The results, presented on Table 8, are as follows:

- Soil pH 7.68 to 8.02;
- Organic matter 2.9 percent to 6.7 percent; and
- Moisture content 14.9 percent to 22.6 percent.

3.4.2 Subsurface Soil Analytical Results

This section presents the subsurface soil analytical results. Subsurface soil samples were collected at varying depths from 3 feet bgs to the water table or where potentially impacted conditions were observed below the water table. Subsurface soil analytical results are presented in Tables 5 and 6. A statistical summary of all detected compounds/analytes is presented in Table 12.

3.4.2.1 Subsurface Soil TCL VOCs

TCL VOCs were detected in 16 of the 119 subsurface soil samples (Table 5). BTEX compounds were the VOCs detected most frequently (Table 12). Styrene was detected in 4 of 119 subsurface samples with concentrations ranging from 4.01 to 27.9 mg/kg. Chloroform, cis-1,2-dichloroethene,

1,1,1-trichloroethane, and trichloroethene were detected in one sample each, with detected concentrations below 0.02 mg/kg.

Maximum BTEX concentrations range from 154 mg/kg (ethylbenzene at SP007) to 369 mg/kg (xylenes at SP025). The highest detected concentrations of BTEX compounds were detected along the property line shared by Property A.

3.4.2.2 Subsurface Soil TCL SVOCs

TCL SVOCs were detected in 28 of the 119 subsurface soil samples (Table 5). A total of 21 SVOCs were detected in the subsurface soil. Concentrations of detected compounds ranged from 0.048 mg/kg (benzo(b)fluoranthene at SP105) to 21,200 (naphthalene at SP009). The most frequently detected SVOCs were the PAHs, including acenaphthylene, anthracene, benzo(a)anthracene, benzo(k)fluoranthene, benzo(a)pyrene, chrysene, fluoranthene, fluorene, indeno(1,2,3-cd)pyrene, phenanthrene, and pyrene. Benzo(a)pyrene was detected in 19 of 120 samples ranging from 0.075 to 2,120 mg/kg. The highest detected concentrations were generally found along the property line shared with Property A.

3.4.2.3 Subsurface Soil Priority Pollutant Metals and Total Cyanide

At least 4 priority pollutant metals were detected in each subsurface soil sample, however thallium was non-detect in all subsurface samples (Table 6). Arsenic, beryllium, chromium, copper, lead, nickel, and zinc were the most frequently detected of the metals. Maximum concentrations for metals were generally in the southwest section of the property north of the high pressure gas lines (SP012, SP033, and SP034). Detected concentrations range from 1.7 mg/kg (mercury at SP033) to 260 mg/kg (zinc at SP012) in this area.

Total cyanide was detected in 13 of 119 subsurface soil samples and ranged in concentration from 0.30 to 81.6 mg/kg. The highest concentration was found along the border with Property A at SP034.

3.4.2.4 Additional Parameters for Subsurface Soil

Two (2) subsurface soil samples (SP001-002 and SP013-002) were analyzed for additional parameters based on field observations. The two samples were analyzed for TCLP VOCs, TCLP SVOCs, TCLP metals, soil pH, reactive sulfide, reactive cyanide, percent ash, percent solids, flashpoint, BTU, and tentatively identified compounds (TICs). Both samples were non-detect for reactive sulfide and cyanide. TCLP-Benzene was the only detected TCLP VOC compound (0.962 mg/kg and 1.1 mg/kg).

TCLP-o-Cresol and TCLP-m&p-Cresol were the only detected TCLP SVOC compounds. TCLP-Barium was the only detected TCLP-metal, ranging from 0.068 mg/kg to 0.1 mg/kg. Soil pH was 7.78 and 7.28 in the respective samples. Analytical results for samples collected and analyzed for additional parameters are presented in Table 7.

3.4.2.5 Subsurface Soil Physical Data Results

Five (5) subsurface soil samples were collected and tested for moisture content, pH and organic matter. Four of these subsurface soil samples were also tested for grain size distribution, and one sample was tested for hydraulic conductivity. The results, presented on Table 8, are as follows:

- Soil pH 7.69 to 8.29;
- Organic matter 1.4 percent to 3.82 percent; and
- Moisture content 14.7 percent to 23.1 percent.

Based upon the grain size distribution, over 83-percent was classified as generally silt/clay and less than one-percent was classified as gravel. The amount of sand varied from 8-percent to 16-percent based on the grain size distribution. The hydraulic conductivity was determined to be 3.9×10^{-7} for sample MW021-003, which was taken at a depth of 8 to 10 feet bgs.

3.4.3 Groundwater Analytical Results

This section presents groundwater analytical results. One groundwater sample was collected from each monitoring well on Property O. Groundwater analytical results are presented in Tables 9 and 10. A statistical summary of all detected compounds/analytes for the Site groundwater analytical results is presented in Table 13.

3.4.3.1 Groundwater TCL VOCs

TCL VOCs were detected in 4 of the 18 groundwater samples, and benzene was not detected in any of the groundwater samples (Table 9). The highest detected concentrations were at MW001 in the southwest corner of the Site near Property A. MW001 had detections of ethylbenzene (0.016 mg/L), toluene (0.0014 mg/L), and xylenes (0.061 mg/L). MW009 was only detect for ethylbenzene (0.013 mg/L). MW021 and MW022 both only had detects of acetone (0.051 mg/L and 0.074 mg/L, respectively).

3.4.3.2 Groundwater TCL SVOCs

TCL SVOCs were detected in 4 of the 18 groundwater samples (Table 9). 2-Methylnaphthalene and PAHs were the only detected SVOCs in the groundwater samples. MW001 had detections of all PAHs, except dibenzo(a,h)anthracene, and also had the highest detected concentrations of PAHs onsite. The detections ranged from 0.0003 mg/L (4 compounds) to 0.028 mg/L (acenaphthylene). MW009 and MW019 had detections of six PAHs ranging from 0.00018 mg/L (benzo(k)fluoranthene) to 3.85 mg/L (naphthalene). Finally, MW010 had a detection of naphthalene of 0.00071 mg/L.

3.4.3.3 Groundwater Priority Pollutant Metals and Total/Amenable Cyanide

Priority pollutant metals were detect in 3 (MW006, MW007, and MW019) of the 18 groundwater samples. The highest metal detections were in MW019, located in the center of the entire former Crawford Station property; and ranged from 0.00034 mg/kg (mercury) to 0.34 mg/kg (nickel). Antimony, beryllium, selenium, silver, and thallium were non-detect in each groundwater sample (Table 10).

Amenable and total cyanide were detected in 4 of 18 groundwater samples (Table 10). Amenable cyanide ranged from 0.019 mg/L at MW003 to 0.287 mg/L at MW009. Total cyanide detections ranged from 0.019 mg/L at MW003 to 0.36 mg/L at MW009.

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4.0 ENDANGERMENT ASSESSMENT

This section discusses the endangerment assessment for the Property O (Peoples Gas) portion of the former Crawford Station.

4.1 CURRENT AND FUTURE USE OF SITE AND SURROUNDING AREAS

Zoning at the Site is Heavy Manufacturing District (M3-3) (City of Chicago 2001), as shown in Figure 6. This parcel is currently owned by Peoples Gas and is used as a city gate regulating and metering facility. The surrounding area is primarily manufacturing and commercial within approximately 1,000 feet of the Site. A majority of the ground surface is covered with grass, and in a few locations gravel, concrete and building structures. A chain-linked fence restricts access to the property. The future use of the Site is not anticipated to change. The surrounding property and site use is not expected to change appreciably in the foreseeable future.

4.2 RECOGNIZED ENVIRONMENTAL CONDITIONS

During SI field activities, three areas of impact were identified based on visual observations at the Site. Figure 7 presents the summary of findings map. Section 4.4.1 presents the source area determination, based on visual observation, for the entire Site.

Odors and/or staining were observed in two areas, and large to small amounts of tars were observed in the third area. The largest area is located along the southwestern property boundary with Properties A and B where tar saturated soil exists from approximately 10 feet bgs to 13 feet bgs, and tar in fractures exists from approximately 13 feet bgs to 15 feet bgs. The tar in fractures was typically observed in the brown/gray silty clay layer and ended before the gray silty clay layer. A small area of surface tar was observed near this area, which overlays the four high pressure gas lines onsite.

The second area containing odors and a sheen is located in the north central portion of the Site at SP111. A slight sheen was observed on the silty clay at 14 feet where refusal was encountered. Probes around SP111 show no such signs of impact.

The third and smallest area of impact is in the section of the Site that runs north along Pulaski Avenue. Probes SP067 and SP068 both had faint odors during sampling, but no visual impacts were observed. While installing MW017, faint petroleum odors were also noticed.

4.3 IDENTIFICATION AND EVALUATION OF EXPOSURE ROUTES

As previously stated, the Site is occupied by Peoples Gas and used as a city gate regulating and metering facility, and a propane peaking facility. The future use of the Site is not expected to change in the foreseeable future. Therefore, exposure routes for soil at the Site will be evaluated with respect to Industrial/Commercial standards. Groundwater at the Site is considered Class II groundwater and will be evaluated as a Class II aquifer.

This section compares analytical data results from the Site to Illinois EPA Tier 1 screening levels. The Illinois EPA developed a three-tiered procedure for evaluating data and developing site remediation objectives based on risks to human health and future site use (Illinois EPA 2001). The first tier, Tier 1, compares concentrations of chemicals detected at the Site to established screening levels. Tier 1 screening levels are based on conservative assumptions and have no site-specific information factored into their development.

In a Tier 1 screening, both soil and groundwater data are evaluated. Soil data is screened against objectives for three separate exposure routes: 1) soil ingestion, 2) soil inhalation and 3) the soil migration to groundwater (soil component of groundwater ingestion). Groundwater data from the Site is compared to Tier 1 screening levels for the groundwater component of the groundwater ingestion exposure route. Tier 1 values and analytical data screening tables are found in Tables 14 through 17.

4.3.1 Ingestion Exposure Route

The Tier 1 soil ingestion exposure route was evaluated with soil samples collected between 0 and 3 feet bgs. Table 14 presents data screened against soil ingestion Tier 1 screening levels. Metropolitan statistical area (MSA) background values listed in Section 742 Table G, rather than the Tier 1 soil ingestion screening level, is used as the screening level for arsenic, as allowed in 35 Illinois Administrative Code 742.415.

Of the one hundred twenty seven (127) samples collected, none of the samples exceeded the TACO Tier 1 industrial/commercial screening levels for TCL VOCs, total cyanide, or priority pollutant metals, except arsenic. Thirty (30) of the samples have TCL SVOC exceedences of the screening level. Benzo(a)pyrene is the most frequently exceeded SVOC, with fewer detects of benzo(a)anthracene, benzo(b)fluoranthene, indeno(1,2,3-cd)pyrene, and dibenzo(a,h)anthracene. Benzo(a)pyrene detects range from 0.874 mg/kg at SP123 (2 to 3 feet bgs) to 49.2 mg/kg at SP044 (2 to 3 feet bgs). Arsenic is the only priority pollutant metal that exceeded the soil ingestion screening levels. Arsenic exceeded the screening level in 29 of the 127 samples.

4.3.2 Inhalation Exposure Route

The TACO Tier 1 soil inhalation exposure route was evaluated with soil samples collected between 0 feet bgs and the water table. Table 15 presents data screened against soil inhalation Tier 1 screening levels.

Out of the 197 samples screened, none of the samples exceeded screening levels for TCL VOCs (except benzene), TCL SVOCs (except naphthalene), priority pollutant metals, and total cyanide. Benzene exceeded the inhalation screening level in three samples and ranged in detected values from 9.5 mg/kg at SP006-001 (1 to 2 feet bgs) to 155 mg/kg at SP025-002 (7 to 8 feet bgs). Naphthalene exceeded the inhalation screening level in two samples and ranged in estimated values from 1140 mg/kg at SP025-002 (7 to 8 feet bgs) to 8350 mg/kg at SP033-002 (4 to 6 feet bgs).

4.3.3 Soil Migration to Class II Groundwater Exposure Route

The TACO Tier 1 soil migration to groundwater exposure route was evaluated with soil samples collected above the water table based on Class II groundwater screening values. Measured values for pH ranged from 7.68 at SP115-001 to 8.29 at SP125-003, in the eight unimpacted soil samples (Table 8). The pH value used for screening the inorganics were based off the range of values above that provided the most conservative level. Screening levels for inorganics are based on the Section 742 Table D for TACO provided by the Illinois EPA which lists screening levels for inorganics in soil with a pH range of 4.5 to 9.0. No pH dependent Tier 1 screening value is available for beryllium, cadmium, chromium, copper, lead, mercury, nickel, or zinc in Class II groundwater. Therefore, the MSA background values were selected for beryllium, cadmium, copper, lead, mercury, nickel and zinc and the Class I groundwater-screening value was selected for chromium.

Table 16 presents the results for the 209 samples screened against Tier 1 screening levels for the migration to groundwater exposure route. Four (4) samples exceeded the TLC VOC screening levels. Thirteen (13) samples exceeded the TCL SVOC screening levels. The compounds that exceeded were BTEX, PAHs, nitrobenzene, and n-nitrosodi-n-propylamine. Benzene was the BTEX compound most often exceeding its respective Tier 1 screening level with a total of four (4) exceedences ranging from 0.279 mg/kg (SP009 from 0 to 3 inches bgs) to 155 mg/kg (SP025 from 7 to 8 feet bgs). Benzo(a)anthracene was the PAH most often exceeding its respective TACO Tier 1 screening with a total of nine (9) exceedences ranging from 9.03 mg/kg (SP035 from 0 to 3 inches bgs) to 3,020 mg/kg (SP033 from 4 to 6 feet bgs). As explained above, a pH range of 7.68 to 8.29 was used to determine the inorganic screening levels. When a pH-dependent screening value was not provided, the MSA background soil values were used, which are found in Table G of Appendix A of TACO. At least one metal in 202 of the 209 samples exceeded the screening levels for the priority pollutant metals. Beryllium was the metal most often exceeding with a total of 197 exceedences ranging from 0.63 mg/kg (SP048 from 0 to 1 foot) to 2.7 mg/kg (SP110 from 5 to 7 feet bgs). Cadmium, chromium, copper, mercury, nickel, selenium, and zinc also exceeded their respective screening level for several samples.

4.3.4 Class II Groundwater Ingestion Exposure Route

Class II groundwater ingestion exposure route TACO Tier I screening levels were used to evaluate the groundwater analytical results. Table 17 presents data screened against Class II groundwater screening levels.

There are no TCL VOC exceedences for the groundwater detections. Two SVOCs were exceeded, benzo(a)anthracene at MW001 (0.0012 mg/L) and naphthalene at MW009 (3.85 mg/L). The only priority pollutant metal or total/amenable cyanide exceedence was lead in sample MW019, where lead was detected at 0.25 mg/L.

4.3.5 Source Area Determination

Based on visual observations, only one area of source material was identified at the Site. This area is in the southwest section of the Site, just south of Properties A and B (Figure 7). Within this area of the Site, tar saturated soil exists from approximately 10 feet bgs to 13 feet bgs and tar in fractures exists from approximately 13 feet bgs to 15 feet bgs. The tar in fractures was typically observed in the brown/gray silty clay layer and ended before the gray silty clay layer. A small area of surface tar was observed near this area, which overlays the four high pressure gas lines onsite.

4.4 FATE AND TRANSPORTATION OF CONSTITUENTS OF CONCERN

This section presents a qualitative evaluation of potential chemical migration pathways and describes the environmental behavior of chemicals that exceeded Tier 1 screening levels. Factors that influence chemical migration include location of source area and degree of concentration, physical integrity of source structures, geological and hydrogeologic conditions and physical and chemical characteristics. This section, which is based on criteria discussed in the preceding sections, focuses on chemical concentrations that exceed Tier 1 screening levels.

4.4.1 Potential Migration Pathways

The main migration pathway to the subsurface is through the sand in the fill layer and fractures in the brown/gray silty clay unit. The gray silty clay has fewer fractures and stopped the migration of the tar further into the subsurface.

A sewer line runs north-south through the property east of the southwest impact area and is a potential preferential pathway. The top of the sewer line is approximately 6 feet bgs and is 18 feet by 14.4 feet. The sewer is constructed of reinforced concrete based on drawings obtained from the City of Chicago Department of Sewers.

4.4.2 Environmental Behavior of Chemicals of Interest

Chemicals of interest detected at the Site are grouped into four basic categories: VOCs, SVOCs, priority pollutant metals, and cyanide. The following subsections describe how chemical properties of the compounds effect the behavior and distribution of the compounds in the environment.

4.4.2.1 VOCs

VOCs have lower molecular weights; are less dense (lighter than water); have higher solubilities and vapor pressures (and therefore more volatility); and a lower affinity to bind to soil particles. The main VOCs of concern are benzene, toluene, ethyl benzene, and xylene (BTEX constituents).

The remaining discussions in this section will address VOC fate and transport primarily based on benzene data because BTEX constituents are similar in physical and chemical characteristics and more information is available concerning benzene's fate and transport.

The environmental fate of benzene under subsurface conditions is controlled by its relatively high solubility in water and low tendency to bind to organic matter. Because of these properties, benzene's presence in water is expected and will be of greater interest than PAHs' presence in water. Benzene is more soluble in water than PAHs and, therefore, benzene will dissolve more rapidly.

Advection is the most probable transport mechanism for benzene and other light aromatic compounds in the subsurface because most of light aromatics readily partition to groundwater. Naturally occurring biodegradation is likely to be the primary mechanism for benzene reduction in groundwater and subsurface soil. The presence of other hydrocarbons, such as naphthalene, is likely to enhance this process (Walker 1975).

4.4.2.2 SVOCs

SVOCs consist of two separate groups of compounds: phenols (also known as acid extractable compounds) and base/neutral compounds including the subclass PAHs. The SVOCs from these two groups that are included in the United States Environmental Protection Agency (USEPA) target compound list were analyzed in each soil and water sample collected at the Site.

Phenols are hydroxy-substituted aromatic compounds that have lower molecular weights, higher water solubilities, higher vapor pressures and lower soil affinity than PAHs. Phenol, or carbolic acid, is the indicator compound used in the environmental behavior discussion of phenols, which is the family name of all phenolic compounds, because all phenolic compounds have similar chemical and physical properties.

Although phenols have higher vapor pressures than PAHs, their vapor pressures are relatively low and have high solubilities; therefore, phenols tend not to volatilize from solution, especially at low concentrations.

Advection is the primary transport mechanism of phenol because of its high water solubility. Phenol is, however, rapidly and virtually completely biodegraded in soils and waters under both aerobic and anaerobic conditions.

PAHs are a class of organic compounds formed during incomplete combustion or pyrolysis of organic material containing carbon and hydrogen (USEPA 1985). PAHs generally have the following characteristics (ATSDR 1995):

- Multi-ringed aromatic organic compounds with densities greater than water.
- Low solubility in water.
- Low vapor pressures, explaining low volatility.
- Generally, low Henry's Law constants (also explains low volatility from water).

- High partition coefficients, explaining affinity for organic matter.
- Relatively low mobility.

Their low water solubility, low volatility and high affinity for binding to particulate or organic matter (ATSDR 1995) primarily define the environmental fate of PAHs. Dispersion is the primary transport mechanism of PAHs throughout the subsurface. Advective transport, or leaching, of PAHs is likely to be limited because of low water solubility and high soil adsorptivity of PAHs. The high affinity of PAHs to bind to organic matter and soil means that the occurrence of these contaminants in groundwater is expected to be limited (ATSDR 1995).

4.4.2.3 Metals

Metals in soils are expected to be less mobile because they form water-insoluble salts and are unable to form soluble complexes with humic and fulvic materials. However, under acidic conditions, some water-insoluble metal compounds may become soluble and move back into groundwater (USEPA 1984).

4.4.2.4 Cyanide

Cyanides generally exist in the environment as complex cyanide compounds. In water, cyanide occurs most commonly in the form of hydrogen cyanide; although, it can occur in ionic forms such as metallic cyanides. Volatilization and biodegradation are significant fate processes of hydrogen cyanide.

5.0 CONCLUSIONS

The overall objective of the former Crawford Station Property O (Peoples Gas Portion) SI was to determine whether constituents of concern are present in surface soils, subsurface soils and groundwater and, if present, define the nature and extent of impacted areas.

5.1 SUFFICIENCY OF DATA

The objectives of the SI were met and the nature and extent of impacted areas were defined to the extent practicable.

5.2 RECOMMENDATIONS FOR FURTHER INVESTIGATION

Remediation objectives will be addressed in the forthcoming Remediation Objectives Report (ROR). The ROR will present remediation objectives proposed to eliminate or prevent exposure to constituents of concern and tar found at the Site.

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TABLES

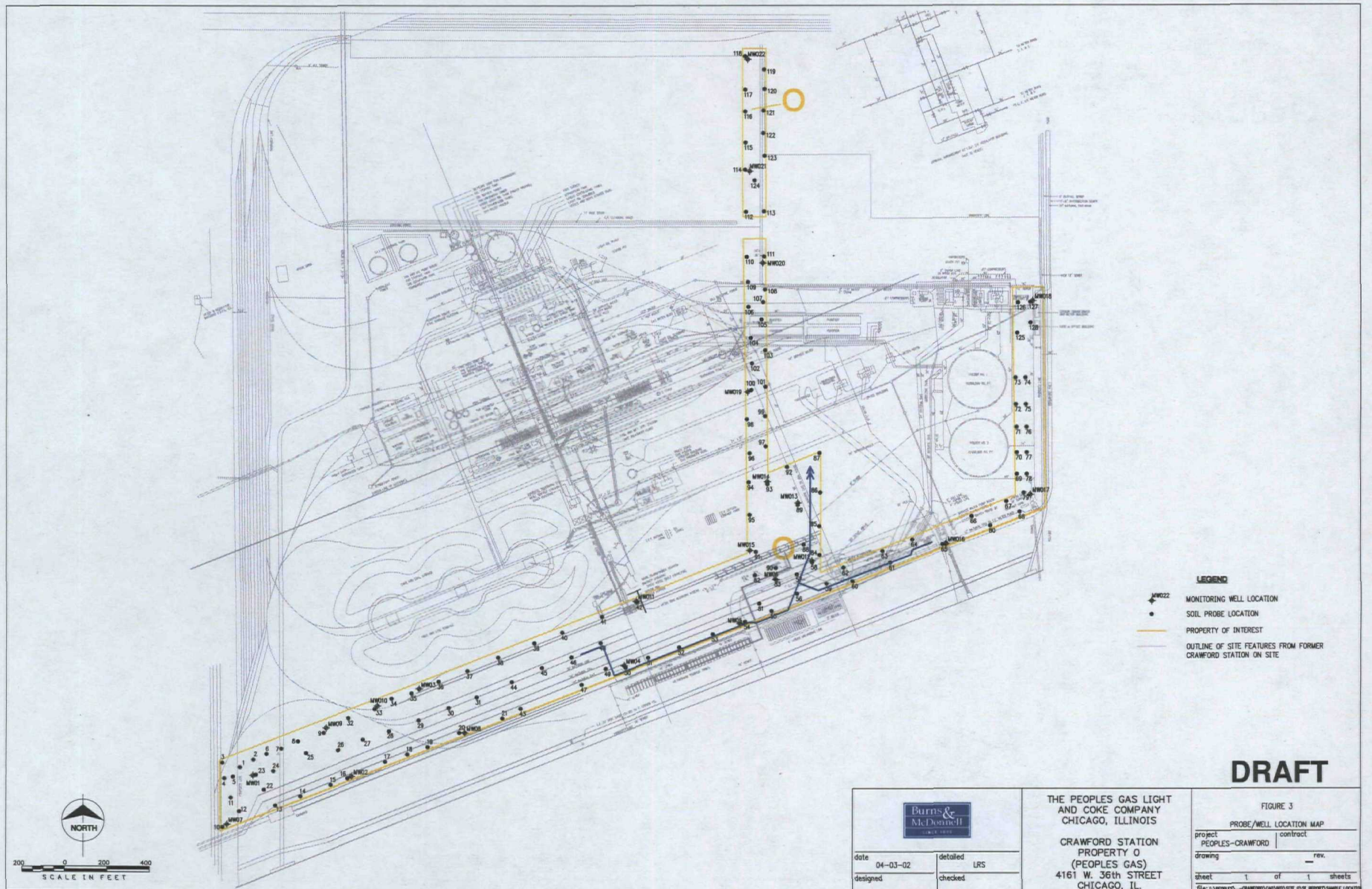
FIGURES



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Figure 1
SITE LOCATION MAP
PEOPLES GAS-CRAWFORD STATION
PROPERTY O
CHICAGO, ILLINOIS



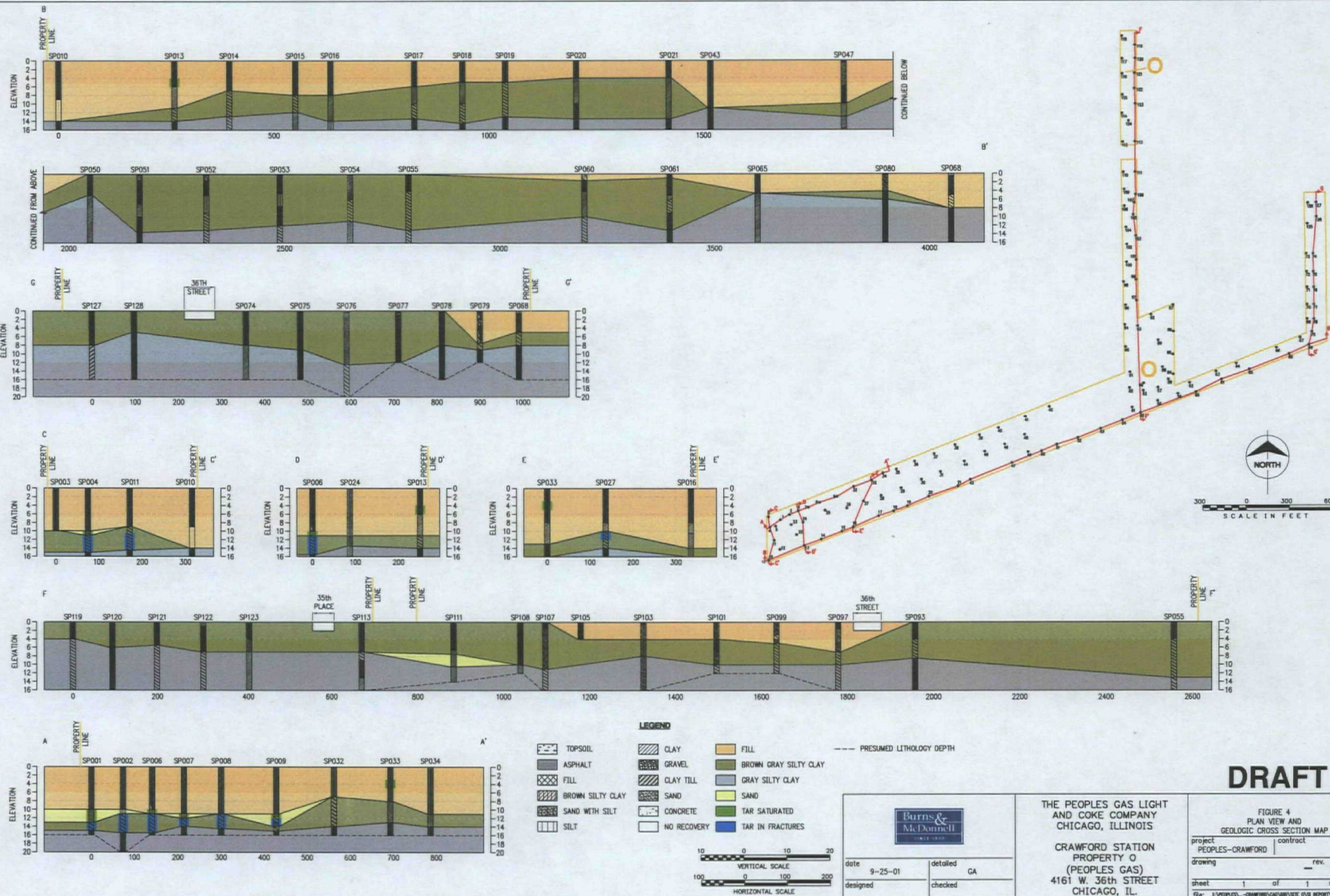
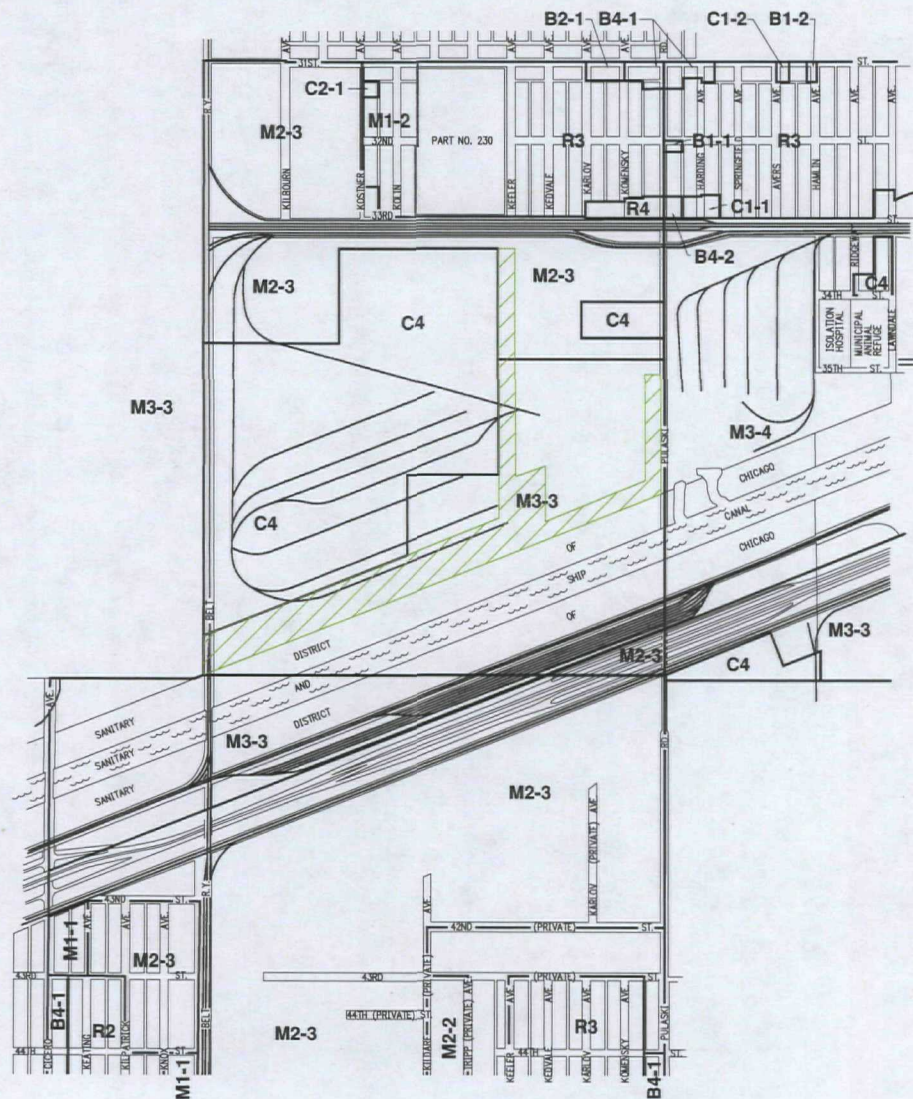


Figure 5 - Groundwater Contour Map pending. To be included in final report.



LEGEND

— ZONING BORDER

M1-1 ZONING CODE

▨ PROPERTY OF INTEREST

— RAILROAD TRACKS

ZONING DISTRICTS

RESIDENCE DISTRICTS

R2 SINGLE-FAMILY RESIDENCE DISTRICTS

R3, R4 GENERAL RESIDENCE DISTRICT

BUSINESS DISTRICTS

B1-1, B1-2 LOCAL RETAIL DISTRICTS

B2-1 RESTRICTED RETAIL DISTRICTS

B4-1, B4-2 RESTRICTED SERVICE DISTRICTS

COMMERCIAL DISTRICTS

C1-1, C1-2 RESTRICTED COMMERCIAL DISTRICTS

C2-1 GENERAL COMMERCIAL DISTRICTS

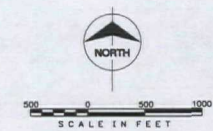
C4 MOTOR FREIGHT TERMINAL DISTRICT

MANUFACTURING DISTRICTS

M1-1, M1-2 RESTRICTED MANUFACTURING DISTRICTS

M2-2, M2-3 GENERAL MANUFACTURING DISTRICTS

M3-3, M3-4 HEAVY MANUFACTURING DISTRICTS



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date 04-03-02 detailed GA
designed checked DJS

THE PEOPLES GAS LIGHT
AND COKE COMPANY
CHICAGO, ILLINOIS

CRAWFORD STATION
PROPERTY 0
PEOPLES GAS
4161 W 36TH STREET

Figure 6
SURROUNDING AREA MAP

project	contract
drawing	rev.
sheet 0	of 0 sheets

FILE: I:\PEOPLESTV\CHAMFORD\CAV\STATE 01\SURROUNDING AREA MAP

APPENDIX A

3813
(35 VO-D)

SCALE 100 FT TO AN INCH

S E V O L S H U L A S K I E R D T W E N T Y - T W O

THE PEOPLES GAS LIGHT & COKE CO.



DRAINAGE CANAL

REPORT FOR BOTH PLANTS
Plant Two Constructed by
S. H. HARRIS, JR., CIVIL ENGINEER
CHICAGO, ILL., 1914
Note: This plant was built by the
Peoples Gas Light & Coke Co. and
was not built under contract.

3814



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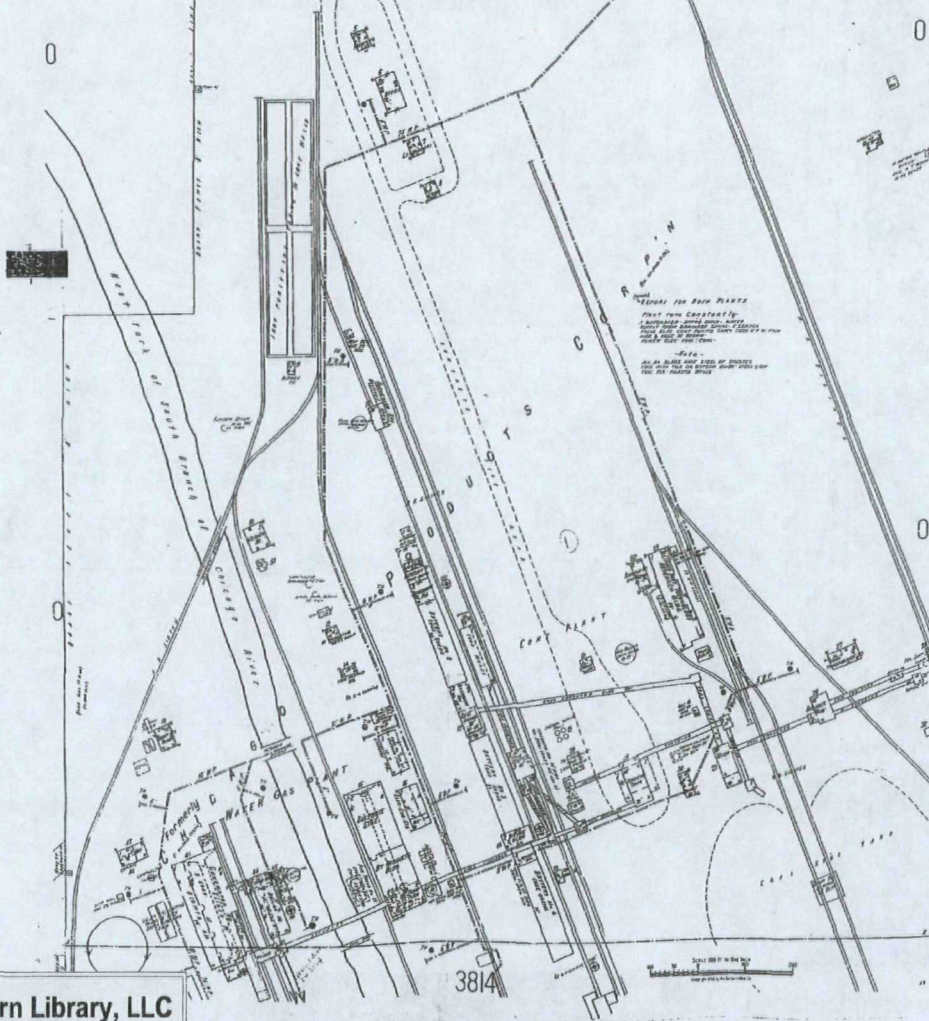
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SCALE 100 FT TO AN INCH

CRAWFORD AV. STR. OF
 THE PEOPLES GAS LIGHT & COKE CO
 CHICAGO



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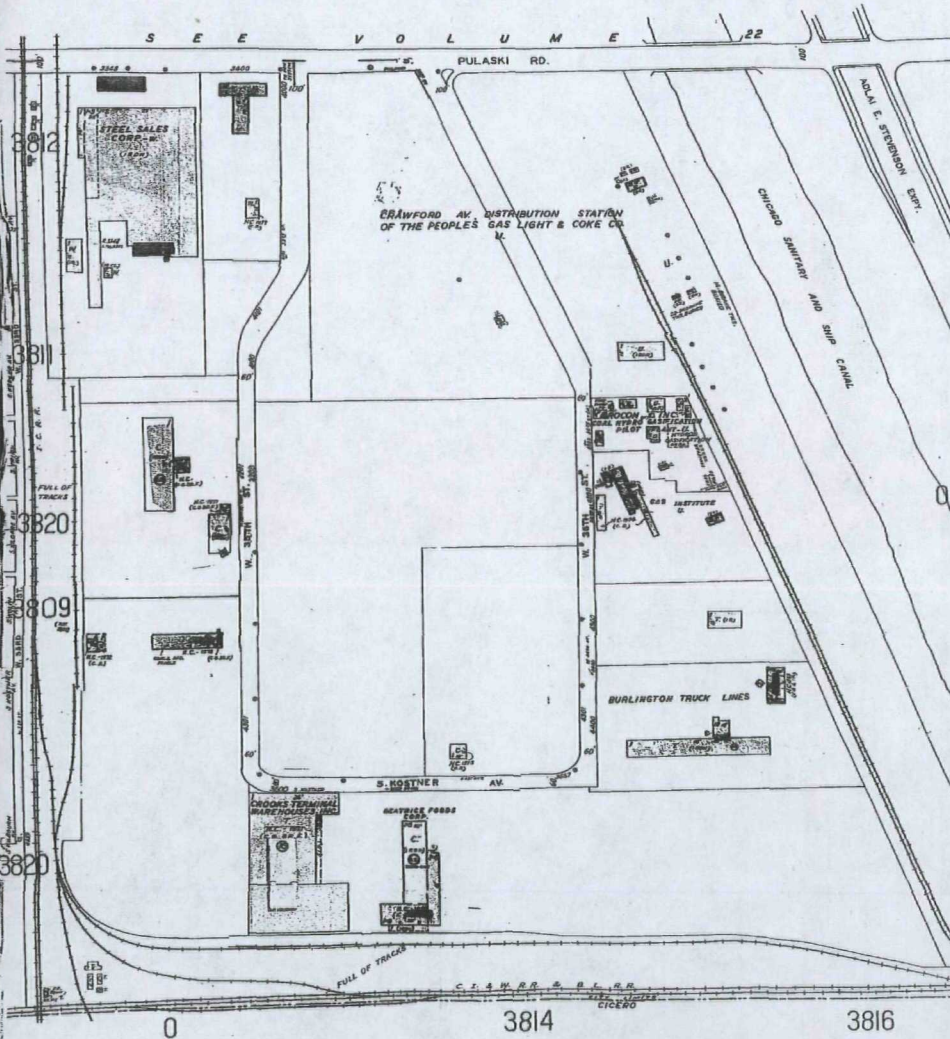
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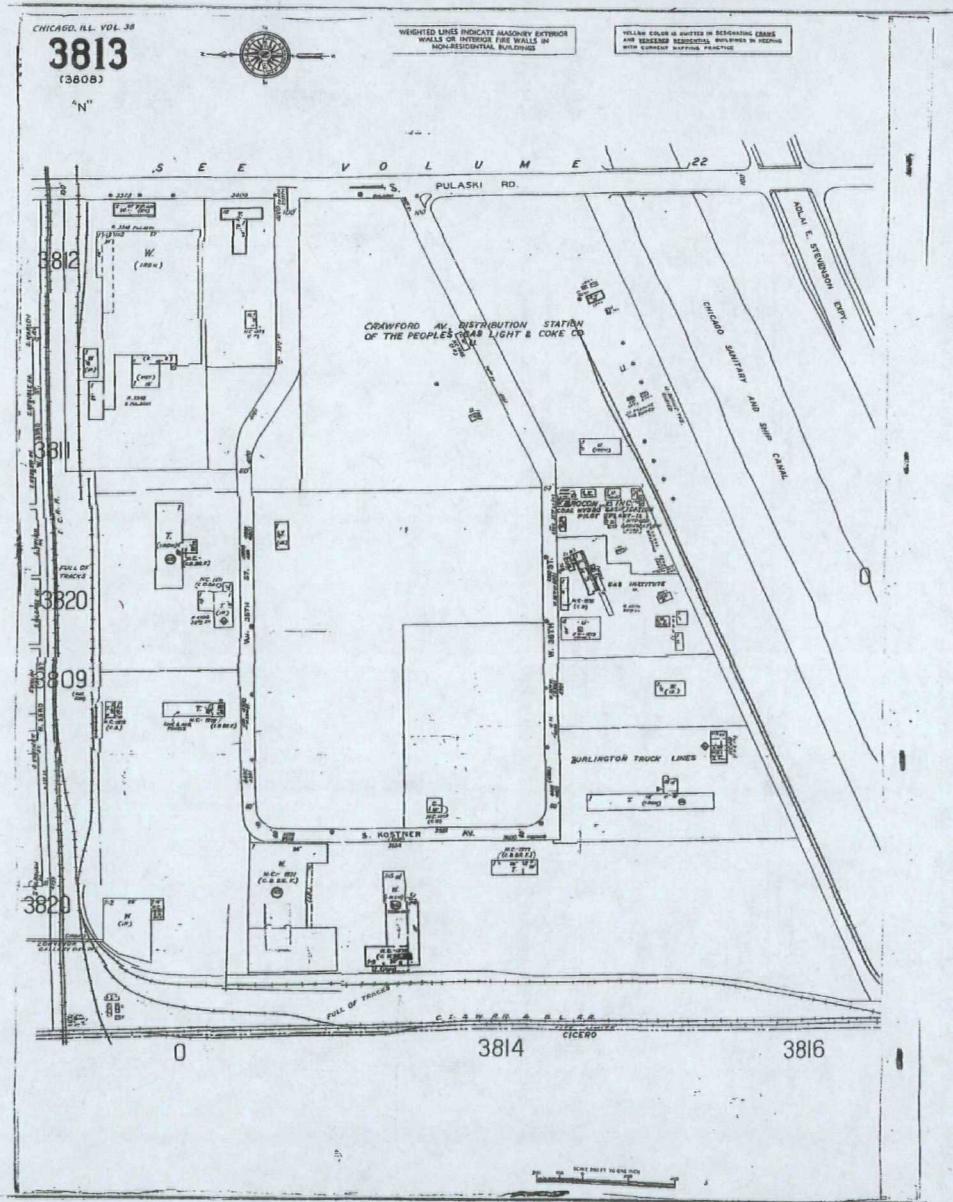


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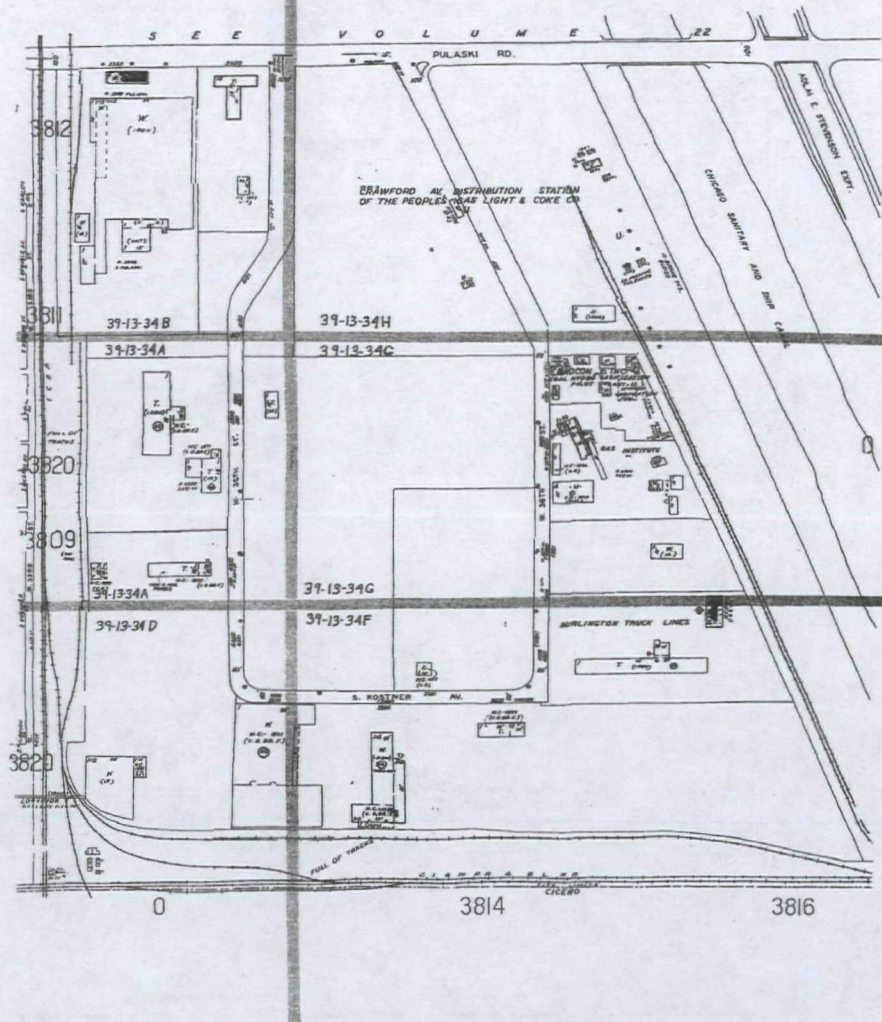
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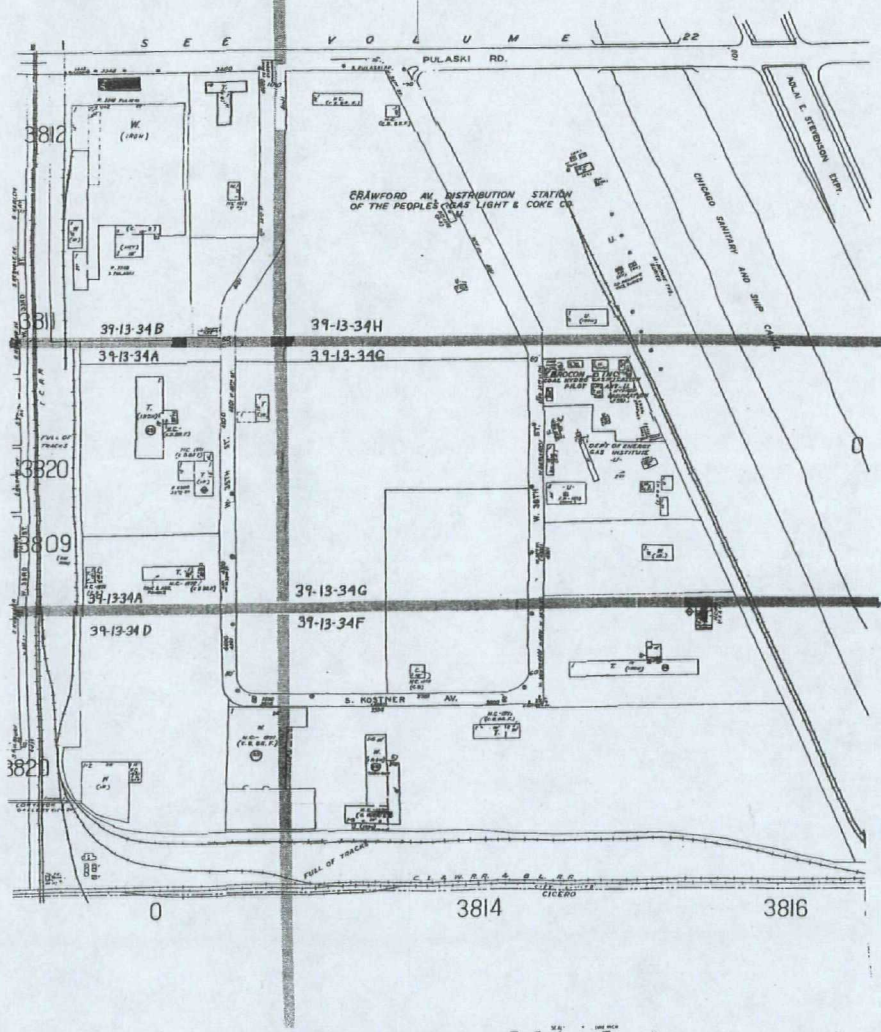
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